DOCUMENT RESUME

ED 383 206 FL 023 006

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TITLE Creating Multimedia Courseware for ESP.
PUB DATE 95
NOTE 11p.; For complete volume, see FL 023 004.
PUB TYPE Reports - Descriptive (141) -- Journal Articles (080)
JOURNAL CIT Edinburgh Working Papers in Applied Linguistics; n6 p18-26 1995

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Authoring Aids (Programming); *Clinical Diagnosis; *Computer Software Development; *Courseware; *English for Special Purposes; Foreign Countries; Higher Education; Language Research; Linguistic Theory; *Medical Education; *Multimedia Instruction; Physical Examinations; Second Language Instruction

ABSTRACT

This report details the development of computer software to teach English-as-a-Second-Language skills for medical diagnosis. Design of a prototype unit of multimedia materials using a common authoring tool required about 300 hours of work over a period of 9 months. The report describes the overall design of the courseware, hardware used, stages of development (preliminary planning, choice of authoring software, structuring and creation of the activity, graphics and sound, programming), planned improvements, problems and issues encountered, piloting with five learners, and time requirements for software development. General issues that needed to be addressed during the process included: minimization of user anxiety; effective screen layout and color use; the format to be use to simulate doctor-patient interaction; the degree of freedom to give the learner in manipulating the materials; and efficient learner navigation through the materials. It is concluded that while creation of this program was time-consuming, much was learned and the development of additional courseware will be more efficient. (Contains 26 references.) (MSE)

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Creating Multimedia Courseware for ESP

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CREATING MULTIMEDIA COURSEWARE FOR ESP

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Abstract

Multimedia courseware can be produced with relatively little technical expertise. We produced a prototype unit of multimedia materials in Microsoft Access 1.10, taking about 300 hours over a period of nine months. A second unit has taken under 100 hours. Our procedure is described and some of the problems and issues which arose during the design stage are discussed.

1. Introduction

Many language teachers have welcomed the arrival of multimedia. Fox *et al.* (1990: 37) point to 'considerable enrichment of the learning environment ... as the spoken word and the "real world" can be brought in'. For Evans (1993: 214): 'The integration of text, sound and visual data clearly is of great benefit to the learner as this will reinforce comprehension, pronunciation and contextual use in a way that traditional materials are unable to do.' Wolff (1993: 27) states of multimedia packages that:

> They can be used to create a rich learning environment which will motivate learners to use the foreign language in an authentic way.
>
> They can be used to provide learning materials adapted to the individual learner's learning strategies and learning styles.
>
> They can be used to help learners discover and practice processing and learning strategies.
>
> They can be used to help learners develop learner autonomy.
>
> (Wolff 1993: 27)

The promise such writers see in multimedia has so far had little empirical substantiation, as Wolff admits (op. cit.: 25). Until multimedia courseware is readily available it is impossible to evaluate it. Although some materials are now appearing on the market, they are inevitably oriented to the biggest market areas, notably English for Business. Materials for other specialist areas are unlikely to be produced commercially for some time to come, if ever.

In January 1994, we decided to see if it was possible to develop appropriate and effective multimedia materials with resources (hardware, software and staff expertise) already to hand. The first part of this objective has been achieved: a prototype unit (*William Evans: a medical case problem*) has been developed using Microsoft Access as an authoring tool. We now plan to pilot and evaluate the material and to see how far it can be used as a template for other units in the same area (English for Medicine), and in others (English for Law).

This article briefly describes the unit and outlines the stages of its development and some of the problems and issues which arose during the process. The material consists of a problem-solving activity for doctors and medical students wanting to improve their English. Many of the decisions we took will apply to other types of problem-solving activity in multimedia format.

2. The material

The activity simulates the information gathering and decision making underlying the diagnostic process. Learners are presented with information about a patient in a variety of forms: letters, written reports, telephone reports, dialogues, X-rays. If they are successful in collecting all the appropriate information, they should be able to solve the case problem and arrive at a diagnosis. The material therefore provides integrated skills practice in a semi-authentic way. It is intended mainly for self-access use, but it could also be used by two learners working together, or indeed a whole class working in pairs (if enough computers are available).

The package consists of text, graphics (including colour photographs), and digitised sound. Learners have taken from 60-90 minutes to work through the material, which contains about 2,000 words of written and spoken text, plus three gap filling exercises. The file containing it occupies about 20 megabytes of space on the hard disk (including sound files).

3. Hardware

We used Dell 486SX 50Mhz machines with 14" SVGA monitors, 200 megabyte hard disks (8 megabytes of RAM), Sound Blaster sound cards, and headphones. The machines are connected by way of Windows for Workgroups 3.11. The main Access file runs off a central server; to facilitate fast response times, accompanying sound files (WAV) are located on local machines where they occupy about 10 megabytes of hard disk space.

In the production stage, some additional equipment was used including a colour scanner for some of the graphics, a microphone, and the recording software provided with Sound Blaster.

4. Staging

We approached the task in three stages corresponding quite closely to those suggested by Keith and Lafford (1989:126).

4.1 Preliminary planning

Four weeks (140 hours) were allocated for the project in the first instance. Two members of staff (the authors) were mainly responsible, with two others assigned to monitor and advise. A Medical English problem-solving lesson was chosen for the project since we thought this type of activity could benefit from multimedia adaptation. It also had the advantage that no time was needed to plan the general content of the unit.

4.2 Choosing software

A number of software packages designed for authoring multimedia programs are available. HyperCard has so far been the most popular with educational software developers (e.g. Evans 1993; Gibbons 1992), largely perhaps because it came free with the Apple Macintosh computer. However, at IALS we do not use Apple Macs, so HyperCard was not an option. Some packages were excluded because of cost (Authorware Professional, IconAuthor). Both authors had previously worked with Guide, which is less expensive, but we had found it difficult to use. We also wanted a more visually pleasing finish to our screens than Guide could provide. We considered Toolbook. Colleagues in other departments in the University had achieved impressive results with it, but it is said to be slow. (See Darby (ed.) 1992a, Fox *et al.* 1992: 37-52, Donnelly (ed.) 1994, Windeatt (1994) and Marshall (1995) for reviews of software.)

We decided, finally, not to use any of these specific authoring packages. King and Murray (1992) have shown how Microsoft Windows 3.1 can be used to create multimedia materials without any additional software. Spreadsheets have been used by other authors (e.g. Young, Heath and Cuttle 1994). We chose a database, Microsoft Access.

As far as we know, we are alone in using Access in this way. In many respects, however, Access is an easier authoring tool to use than purpose-built programs such as Toolbook or Guide. Individual screens are created from Access 'forms', macros take care of most of the manipulation of these forms (without the need for programming), and student file input/output is largely taken care of by Access tables. On-screen menus are fully customisable. For more complicated features like gap-filling exercises and navigational maps, Access Basic provides an industry standard programming interface that does not require learning a proprietary language.

4.3 Structuring the activity

As we have said, it was not necessary to spend time in the pre-design phase on planning the overall content of the program, since it was to be based on a well-tried classroom activity. Some care was taken, however, in choosing the particular medical case problem. (We used one from Taylor, Armstrong and Carroll 1987. See Ferguson 1991 for a discussion of ways such case problems can be used.) We looked for a case that was interesting and challenging but not too difficult, and that gave scope for the use of graphics (X-rays, for example). We also gave considerable thought to getting the right balance between tasks that were purely communicative and those that were more language focused (Johns and Davies 1987). We finally opted for weighting the former. We have included three gap-filling exercises, one at the end of each section (history-taking, examination, laboratory tests), but even in these it is content words which are deleted, and their main function is to provide the learner with feedback on the success of information gathering.

4.4 Creating the activity

One of us (RH) next created the text of the program on paper, form by form[1] with an indication of the links between them. Figure 1 shows an example of the preliminary design for one form.

Form 3: History
You have decided to obtain more information from the patient.
Choose one or more of the following:

1. Personal details	→	form 4
2. Social history	→	form 5
3. Main complaint	→	form 6
4. Family history	→	form 7
5. Past history	→	form 8
6. Systems enquiry	→	form 9
7. Quit		

Figure 1: *Sample of the preliminary design of a form*

4.5 Graphics and sound

The next step was to collect graphics and sound for each form. Graphics consist of proformas, line drawings and photographs. Some of these, e.g. the proformas, are integral to the activity while others are simply intended to make the program look more attractive to the learner.

One graphic consists of a line drawing of the patient's abdomen. The learner is required to 'palpate' the abdomen by clicking the mouse on different areas. When the painful area is touched, the patient is heard saying: 'Ouch! That hurts!' (Figure 2). This particular task does not make any linguistic demands on the learner (beyond understanding the instructions), but we believe it serves the purpose of helping to make the activity enjoyable.

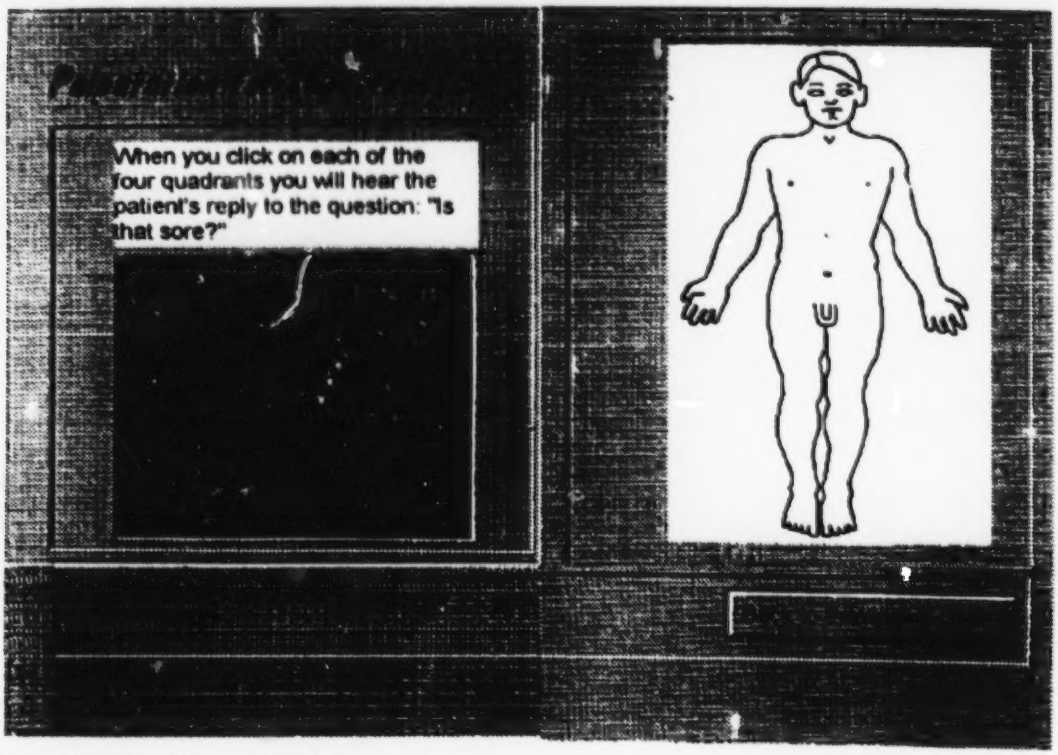

Figure 2: *Screen from William Evans*

Proformas, based on authentic examples taken from local hospitals, were created directly in Access. Colour photographs, e.g. of hospital departments, were taken by one of the authors (PG). Others, e.g. the photograph of the 'patient', were taken from clip-art files. In the form illustrated by Figure 2, a speech balloon was added to a clip-art photograph using Paintbrush.

Sound consists of responses from the patient to the learner's questions, and spoken reports of laboratory tests. These were scripted and recorded through a microphone directly onto the hard disk.

4.6 Programming

The 'storyboard' was next converted into Access forms by PG. Decisions on graphics and layout for each screen were made sometimes at the storyboard stage, sometimes during programming, sometimes later.

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Although we met periodically to evaluate the work-in-progress, the division of labour meant that for most of the time we could work independently and were not constrained by the need to find time when we were both free to work on the project. On the other hand, the fact that PG has taught medical English and that RH is moderately familiar with computers made the collaboration more efficient.

5. Further developments planned

The unit is now functional, although we hope to continue making improvements - some minor, some more substantive. For example, we will eventually add a local glossary with contextually appropriate meanings of key words.

6. Problems and issues

In the course of design and implementation a number of problems arose, some general, and some specific to the material. In this article, we will restrict ourselves to discussing the former.

6.1 Design

The effects of user anxiety when interacting with computers are fairly well documented (see Todman and Lawrenson 1992). To try and minimise the stress of using a computer, several design issues were agreed on at the outset:

- The user would interact with the computer primarily by means of the mouse and would therefore need no knowledge of the operating system.
- Options would appear as a series of 'buttons'. The user chooses by clicking on a button.
- Where users were required to perform tasks (such as filling in proformae, answering questions, etc.) they would have the option of doing so on screen or on paper.

6.2 Screen layout

We accepted as given that to make the screen as clear and attractive as possible, text should be kept to a minimum. A basic design of four frames was adopted (title, instructions, graphic, option buttons) with a toolbar at the bottom, but variations are possible. Scrolling is never necessary. We experimented informally with the placing of text in relation to graphics. When more than one frame contains text, we have found that an enlarged capital (a 'dropped' capital) at the beginning of the first word draws the eye to the text which should be read first. We used different fonts and different colours sparingly, following the two-colour two-font rule. High contrast colours were chosen. The guidelines on design in the Microsoft Access manual were useful.

6.3 Learner input

In the history-taking stage of a medical consultation, the doctor obtains information by interrogating the patient. In our simulation, the learner plays the part of the investigating doctor and all other roles including that of the patient are assigned to the computer. It is a simple matter to reproduce the patient's responses as digitised speech. But how to have the learner-doctor address questions to the computer-patient posed more of a problem. The potential solutions are:

1. The learner speaks the questions. This is not possible with the technology available at present.
2. The learner types the questions. This is off-putting for some learners (see Section 7) and, although technically possible, getting the computer to accept all the possible valid questions would have involved far more programming than we were able to undertake.
3. The learner selects questions from a menu. This was the method used.

Even in the case of the option we chose, variations are possible. We considered the possibility of offering learners a choice of questions, which could be (1) acceptable, (2) grammatically incorrect, or (3) grammatically acceptable but pragmatically inappropriate. However, this was eventually rejected, partly to limit the size of the program (see also below on the number of questions), and partly because we thought having to switch from a communicative task to a language-based one may be confusing to the learner.[2]

A very large number of questions could be asked in this situation. To include them all would have taken up an inordinate amount of time and space. We therefore felt we had to limit the number of questions in some way. One solution we chose for a particular part of the history-taking section was to present a batch of information in the form of a patient response questionnaire, an idea taken from a medical source (Short 1986).

In *William Evans*, the learner is therefore presented with a limited set of questions, each intended to elicit a different piece of information. (See also Gibbons 1992.) The question forms will normally have been taught in classroom lessons; our simulation is intended to provide additional exposure to these forms to reinforce classroom learning. A few redundant questions have been included to make choice more meaningful, since observation shows that otherwise learners simply select all questions (medical thoroughness?). When one of the redundant questions is selected the computer reproaches the learner. If we had adopted a scoring system (see below), it could have earned the learner a negative mark.

6.4 Interactivity

The question of how much freedom to give the learner is one of the main issues we faced. The view that too much freedom is counterproductive seems to be a gaining ground in the literature (e.g. Sciarone and Meijer 1993), although initially the autonomy possible with CALL was seen as one of its chief advantages. Freedom of choice could be undesirable if it bewilders learners or if it allows them to make clearly wrong choices. We hope we have avoided both dangers.

As well as being able to choose whether to use pen and paper or the keyboard to enter responses (see 6.1), learners have a number of other choices.

Choice of path: They can choose which path to take in order to solve the diagnostic problem. If we were teaching medical diagnostic skills, this would not be a real choice since a doctor or medical student would be expected to follow the well-established path of history-taking first, then examination and finally laboratory investigations. There would be one correct path, and all others would be incorrect. Medical programs of this type often award points for taking the optimal steps in the optimal sequence, and penalise any deviation. We have so far resisted the temptation to include a scoring system since this would encourage the impression that this program is designed to teach medicine rather than language. We feel it is important that the learner is aware of the distinction, although at the same time we have tried to make the program medically exact.

Transcript: An onscreen transcript is available for the longer listening passages. Learners can choose to read this before, while or after they listen. While they are encouraged to listen first *without* the transcript, we do not know of any evidence for the superiority of this approach for *all* learners and have therefore allowed them to choose. Other multimedia producers have taken a different decision (Moses 1991). The few learners who have so far tried the material all listened first without the transcript, but it has to be admitted that the presence of one of the authors (see Section 7) may have been an influence. After evaluating the material with a larger number of learners we will of course review our decision.

Feedback: Learners are free to complete the activity without obtaining any formal feedback, if they wish. Optional listening and reading comprehension checks are, however, provided in the form of gap-filling exercises. As mentioned in Section 6.1, learners are given the option of doing these exercises on screen or on paper. Feedback in the latter case consists of a completed version of the exercise which can be printed

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out. In the former case, after typing in an answer the learner clicks on the word, and the computer responds with: 'Your answer is correct' or 'Your answer doesn't match the computer's answer. The computer's answer is xxx.' This is a very simple way round the complex problem of how to deal with incorrect and near correct answers. (See, for example, Race and Brown 1994). Ideally, one would deal with errors in a more constructive way but it was necessary to compromise in view of the limited time available. We chose a version of gap-filling in which the first or even the first two letters are given. This has the advantage in a computer program of limiting the possible number of correct answers to one in most cases, although the program handles two possible answers in one or two cases.

It would be possible to design the program in such a way that learners are forced to follow a fixed path through the activity, and complete each section including its gap-filling exercise before they are permitted to go on to the next. We were reluctant to impose this type of constraint since we felt it would upset the delicate balance between user control and computer control too much in favour of the computer.

6.5 Navigation

Because learners will normally want to follow the standard path (see Choice of path, above), navigation is not as much of a problem in this simulation as it often is. However, we have observed that learners quite often wish to retrace their steps, for example to check on information they did not quite take on board in an earlier section. In addition, they may decide not to do the gap-filling exercises after solving the problem. A map showing the main sections of the activity can be obtained by clicking on Tools at any time. This provides an overview of the simulation, shows learners where they currently are (large arrow), and allows them to move to any other section by clicking on the appropriate box.

7. Evaluation

To date the material has been tested on five learners. They worked individually, with the observer (RH) sitting beside them making notes on such things as problems with navigation, time spent on particular tasks, choices made, etc., and intervening only when requested. This procedure is time-consuming but worthwhile with a small number of learners. The feedback obtained has already led to improvements in the program. For example, following a comment from one doctor, the map will be shown to the learner at the start to provide an overview. All five learners preferred to fill the gaps in a printed version rather than on screen. We have decided to leave the option of on-screen filling in place for the moment but it may turn out that it is not worth retaining this option if it continues to be ignored. Unnecessary choices increase the risk of confusion (see 6.4) and should be eliminated as far as possible.

8. Time

Johnson (cited in Keith and Lafford 1989:126) estimates 600-1000 hours of development time for a single unit. Gibbons (1992:26) claims that he and his team took about 1800 hours to create their legal simulation *Murder One*: 'Four people executed *Murder One* in the interstices of otherwise busy schedules over the course of ten months.' Their product is being marketed; we would not claim to have brought ours up to that standard. In a study cited in Reinhardt (1995:70), the mean number of hours required to create a single hour of courseware was 228 hours, and this corresponds more closely to our experience.

Officially, we had 140 hours for our project, but in fact a better estimate of the time taken would be 250 hours. This excludes time taken for PG to become more familiar with the software—probably another 50 hours—and some secretarial time. A second unit has almost been completed, using the first as a template and changing only the data[3]; time spent so far is about 70 hours.

9. Conclusion

We have demonstrated that it is possible to create multimedia materials tailored to the needs of a special group of language learners with relatively simple and inexpensive tools. 300 hours may seem a lot of time to spend creating one hour's worth of material. But we learned a great deal in doing so, and the materials could not have been obtained any other way. Subsequent units will certainly be easier and faster to produce.

Acknowledgements

We are grateful to Eric Glendinning and John McEwan for their advice and help with the project, and to Eileen Dwyer, David Cole and Noni Goertzen for speaking the lines of dialogue. We would also like to thank Edinburgh University Computing Services for making the scanner available to us.

Notes

1. Each screenful of information corresponds to an Access 'form'.

2. This impression was confirmed during trials. Learners seemed reluctant to abandon the information gathering process to do a cloze exercise.

3. Not entirely true: it was impossible to resist making a few changes in format and procedure.

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